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(56) Documents cited
GB 1446335 A GB 0274170 A EP 0377397 A2
US 4925053 A US 4602611 A US 4361190 A

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(71) Applicant
James R Adams & Associates Ltd

(Incorporated in the United Kingdom)

5 Langley Street, London, WC2H 9JA, United Kingdom

(72) Inventor
Ladislav Nevin

(74) Agent and/or Address for Service
James R Adams & Associates Ltd
5 Langley Street, London, WC2H 9JA,
United Kingdom

(54) Metal net and metal tangle anti-fire applications

(57) Anti-fire applications of metal structures comprising metal net, metal wool or metal tangle through which gases may easily pass are claimed. These may be in the form of an extinguishing carpet comprising combinations of plain and shaped nets alternating in the carpet, the top side of said carpet preferably being covered with metal foil for rapidly extinguishing fires of spilt inflammable liquids. The nets may be sprayed with water, or in the form of rigid panels. Preferably these are placed over inflammable materials (eg a ships hold), used to form an escape gangway.

Similar metal structures for passive anti-fire protection in the form of fire bulkheads, anti-fire covers of fuel tanks, and fire-resisting shells for passenger and crew cabins and spaces in aircraft, vehicles, ships and boats.

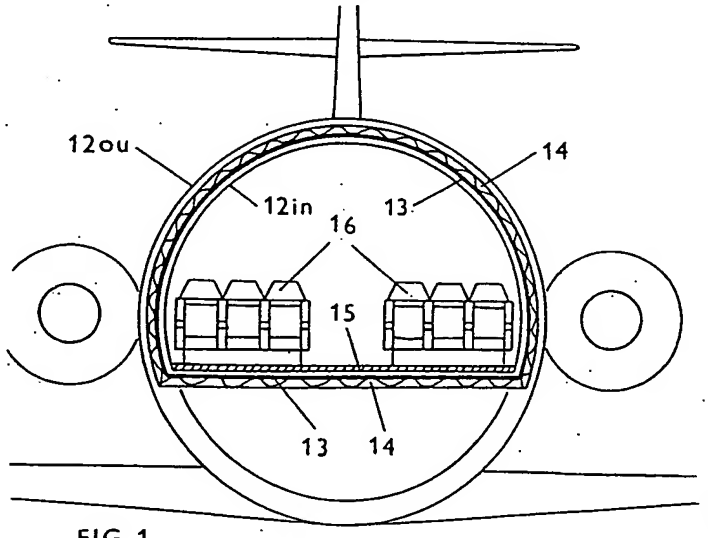

FIG. 1

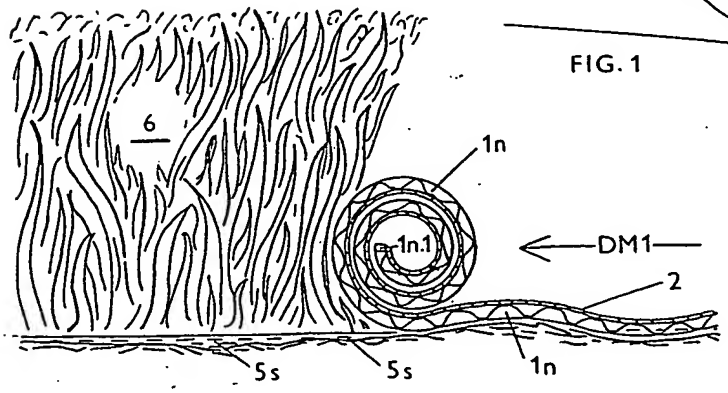

FIG. 7

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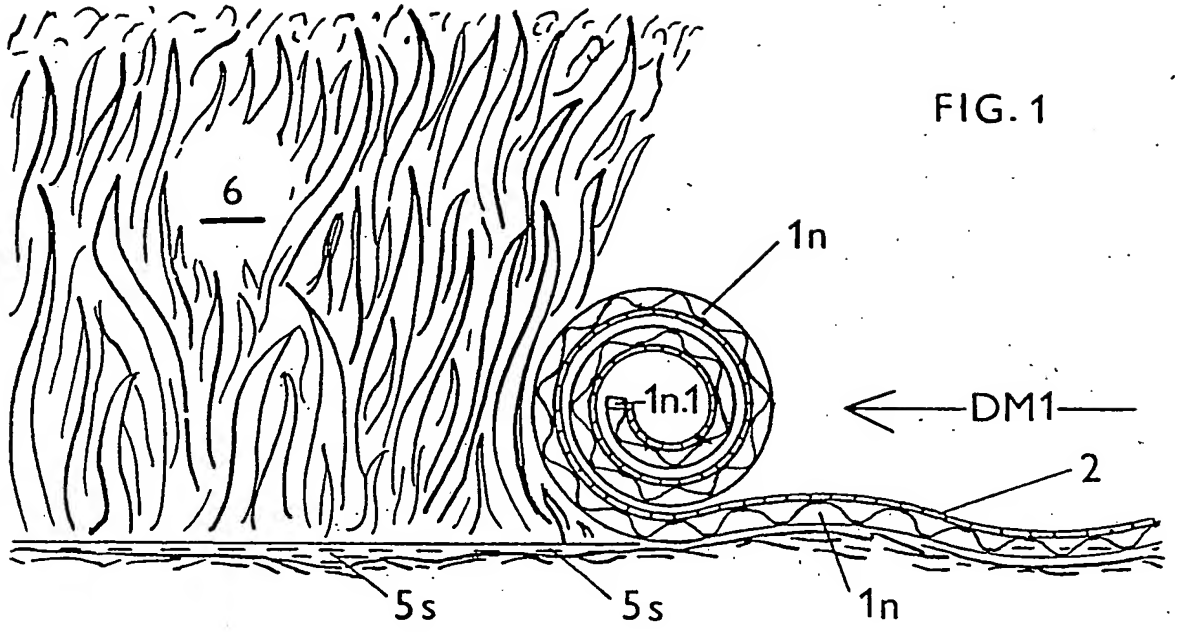

FIG. 1

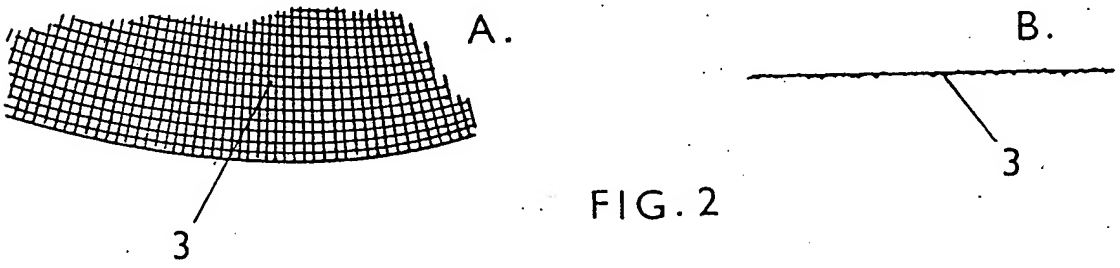

FIG. 2

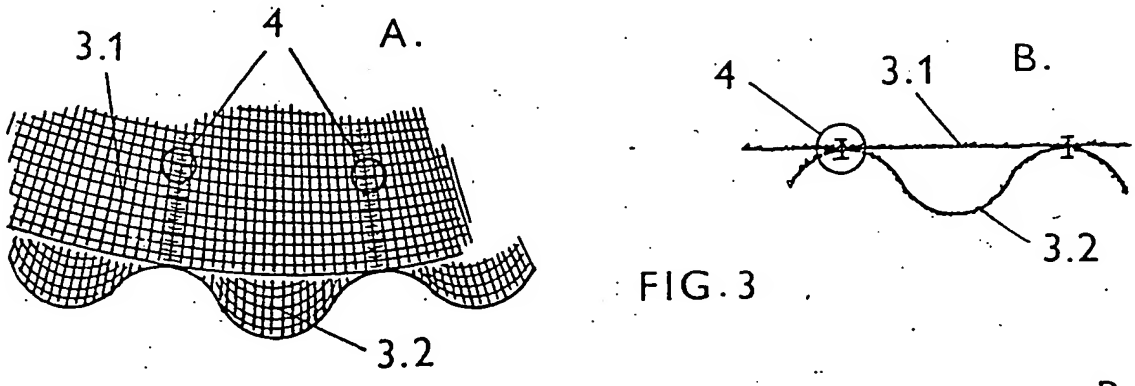

FIG. 3

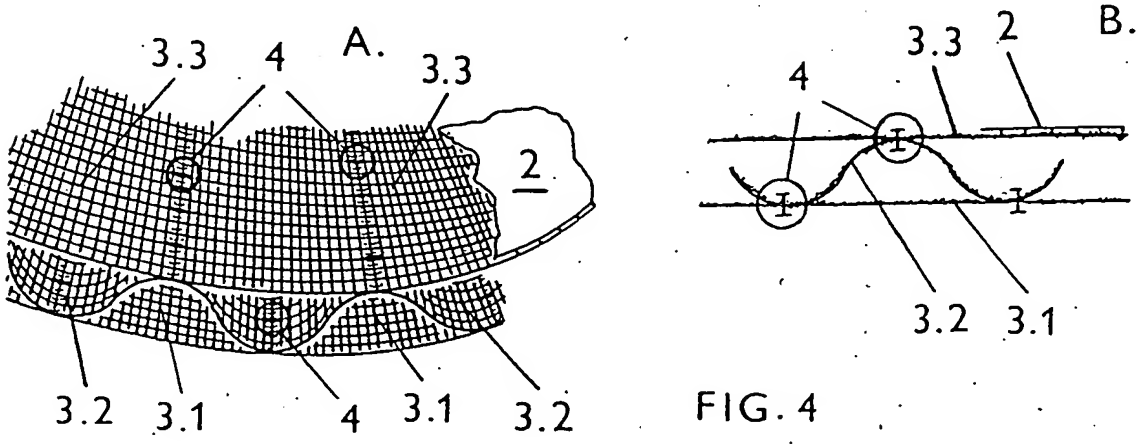

FIG. 4

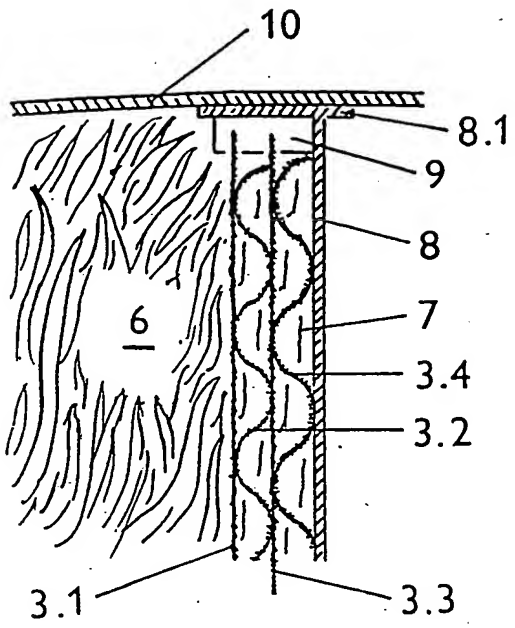

FIG. 5

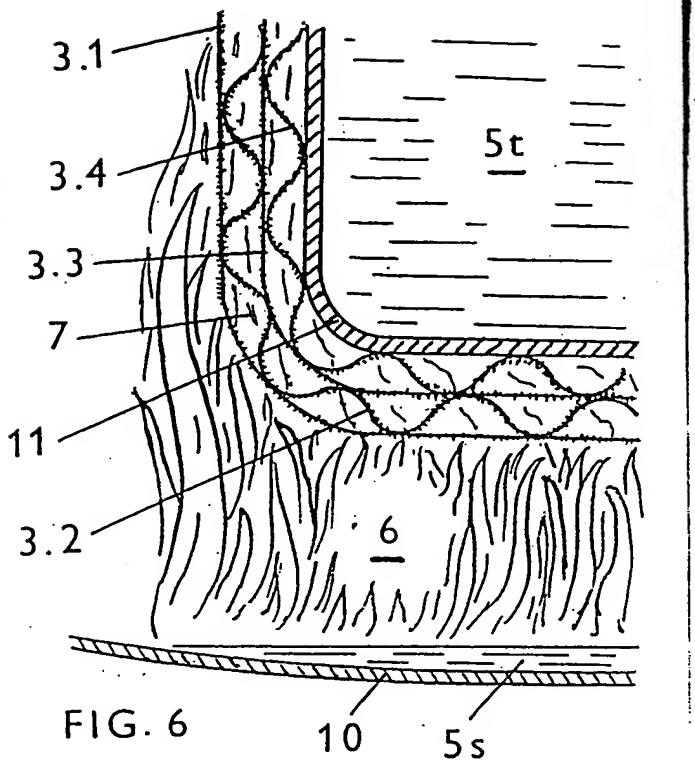

FIG. 6

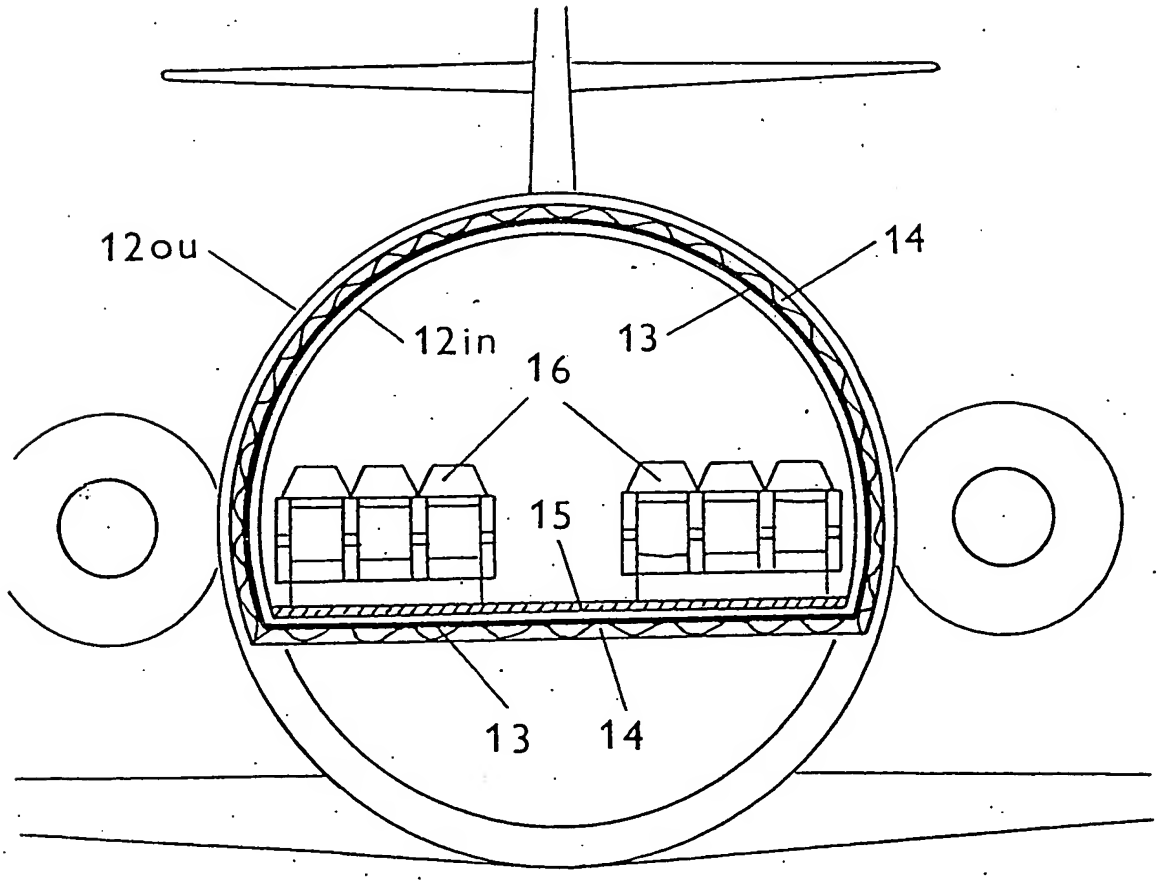

FIG. 7

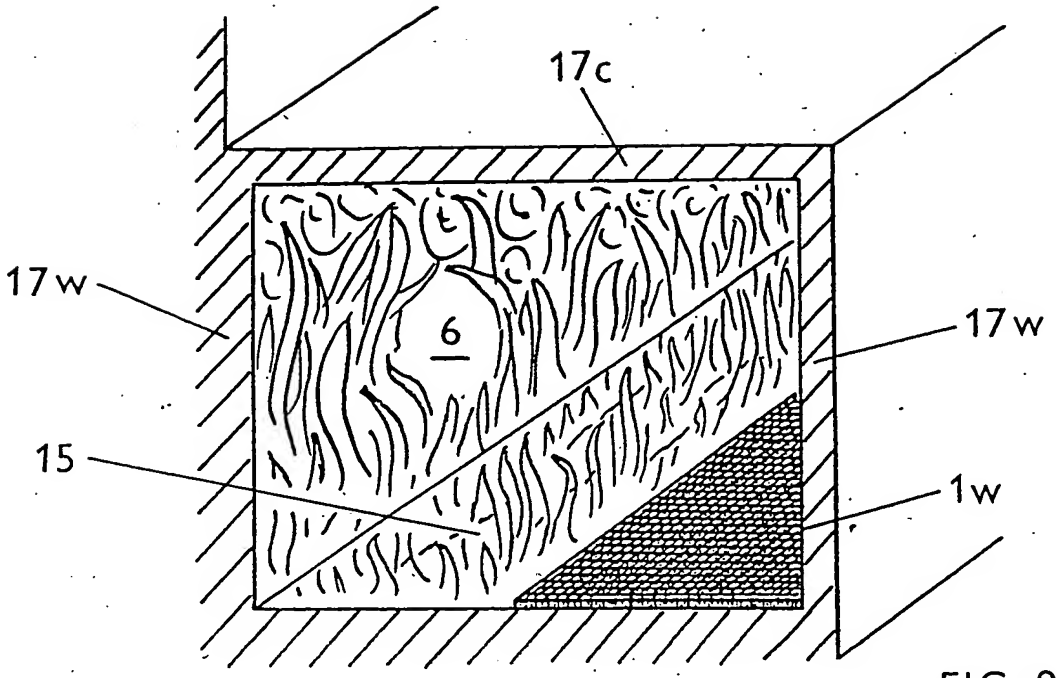

FIG. 8

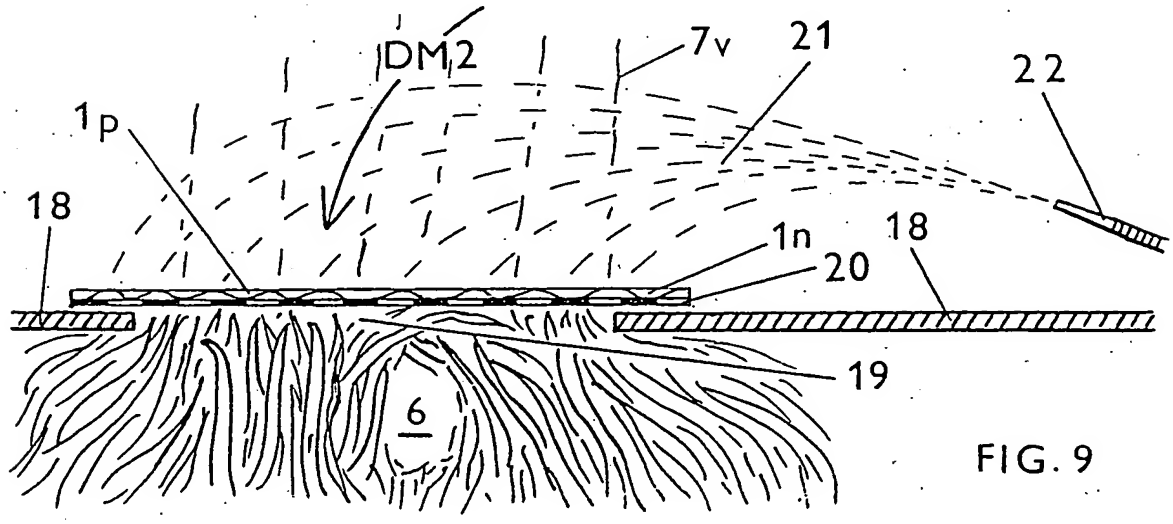

FIG. 9

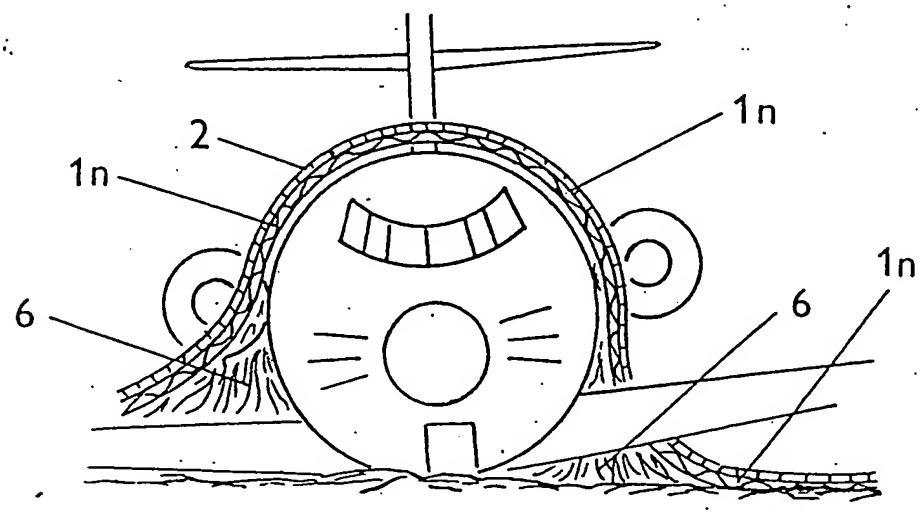

FIG. 10

Metal Net and Metal Tangle Structures for fire-fighting and fire protection

This invention relates to the use of metal nets and metal tangle structures for fire-fighting and passive anti-fire applications.

There are places and situations where conventional fire-fighting means (such as spraying with water or foam) are neither fast nor effective enough: such as fires in aircraft, vehicles, ships and boats, oil tankers, and buildings in which people are trapped. There is also room for improvement in the passive protection of fuel tanks, passenger and crew spaces in aircraft, vehicles, ships and boats.

The present invention is for the use of fine metal nets and metal tangle to improve such situations. The first active application of this kind comprises one or more fine plain and shaped metal nets alternating in an extinguishing carpet, which may be covered with a changeable metal foil, for extinguishing fires of spilt oil, petrol, kerosene and the like after accidents to aircraft, vehicles, ships, boats or storage tanks. The carpet can be rolled out to put on or pull over the burning object so as to immediately reduce the fire to a minimum or to extinguish it completely.

A similar extinguishing carpet not covered by foil, but sprayed with water, would rapidly extinguish surface fires of spilt combustible liquids as mentioned above. A special version could be produced for motor vehicles, able to reduce fires in the engine to an absolute minimum, easily extinguished by a portable fire-extinguisher. A further version of the uncovered extinguishing carpet with a supporting frame, designed to be sprayed with water, could cover openings in the decks of ships and/or underground storage spaces so as to prevent the supply of oxygen from the air to materials on fire under the openings. Panels formed in this way could be laid over volatile materials and liquids open to fire risks as a preventative measure.

The second active application comprises two plain metal nets with coarse metal wool held between them, of sufficient density to impede the penetration of gases, as a mat to assist in the escape from corridors and gangways in buildings, ships and mines where split fuel is burning after an accident, or fires have started for some other reason.

The passive protection application of the above metal structures comprises one more more combinations of one plain and one shaped metal net together with an impervious metal sheet wall to form a fireproof bulkhead in aircraft, vehicles, ships and the like.

This application could also apply to the protection of fuel tanks, ammunition boxes and the like, and for forming a fire-resisting shell for crew and passenger quarters in aircraft, vehicles, ships and boats, giving much improved chances of survival in case of fire. Another version of this fire-resisting shell uses coarse metal wool instead of nets.

These described applications are feasible, simple, inexpensive, combining high effectiveness with low weight and low volume.

Specific embodiments of the invention will now be described by way of example, with reference to the accompanying drawings in which:

Fig. 1 shows an extinguishing carpet being used to extinguish a fire of spilt inflammable liquids

Fig. 2 shows a plain metal net

Fig. 3 shows a basic combination of metal nets

Fig. 4 shows a complete structure of the extinguishing carpet in Figs. 1 and 10

Fig. 5 shows a fire-proof bulkhead

Fig. 6 shows a fire-resisting cover for a fuel tank

Fig. 7 shows a cross-section of a fire-resisting shell in the fuselage of an aircraft

Fig. 8 shows the application of a fire-extinguishing mat in a burning corridor

Fig. 9 shows the application of a rigid extinguishing panel sprayed by water

Fig. 10 shows the front view of the reduction of an aircraft fire by the extinguishing carpet also shown in Fig. 1

Detailed Description

This invention is based on the cooling and heat-exchanging between metal structures such as fine metal nets, coarse metal wool and combinations of them, and the surrounding atmosphere. Metals generally absorb heat quickly and radiate it with the same ease to equalise their temperatures with their surroundings. These properties can be illustrated by the well-known phenomenon of inserting a fine metal net into a flame. Burning gases are cooled by passing through the net sufficiently to extinguish the flame. This phenomenon can be used in both active and passive fire-fighting.

The aim of this invention is not to replace existing fire-fighting and fire protection techniques, but to complement and broaden the spectrum of active and passive methods available, particularly where these methods have specific advantages, and where speed is of particular importance.

In all fires, but particularly larger fires, a major problem is the updraught caused by the masses of heated air rising, and drawing in fresh oxygen to the fire, associated with radiant heat causing the heating and gasifying of combustible materials near to the fire. Conventional spraying by water or foams does little to affect this phenomenon. The application of metal structures as described will reduce the heat and restrict the flow of oxygen to the fire in such a way as to extinguish or at least reduce any fire to a minimum.

There is also a strong psychological effect on fire-fighting personnel at large fires, where the flames and radiant heat, together with the risk of explosions or structural collapse makes approach to the fire difficult and dangerous. Using one of the metal structures described has the effect of the immediate reduction of the rising heat, and the accompanying reduction of the fire to a minimum, with the consequence of reduction in its spread. Using one net only is enough to reduce dramatically or extinguish completely an extensive fire.

Any residual fire remaining can be extinguished easily by the application of water or foam sprayed on top of the net. The net also restricts the possibility of re-igniting. Spraying the net multiplies the efficacy of the treatment by forming a liquid and vapour seal excluding oxygen completely.

The passive application prevents the passage of direct flames from one side of the metal structure through to the other, so lowering the danger of fire or explosion and giving efficient protection against flames to people in various methods of transport.

The basic working requirements of all the metal structures described are the minimum of direct contact between the metal elements (as in a net) and the free flowing of gases through the structure (except in the case of the mat), the structure being fine enough to cool the gases below their ignition temperature.

Referring now to the drawings, we see in Fig. 1 an illustration of the rapid extinguishing of spilt liquids 5s (such as petrol, oil, kerosene etc) burning to flames 6, by means of an extinguishing carpet 1n covered by an impervious renewable metal foil 2 on its upper side. The parts of the carpet 1n are fixed together by end clamps 1n.1. The extinguishing carpet, stored in a roll, is being rapidly rolled out over the burning field in the direction DM1, extinguishing the fire as it goes. Extinction takes place by cooling by the nets 1n and the exclusion of oxygen by the foil 2.

Fig. 2A shows in perspective the metal net 3 as a basic structural element of the extinguishing carpet 1n in Fig. 1 and the other metal structures described below. The metal net 3 may be made of steel or brass wire 0.1-0.3mm in diameter according to the material chosen and with meshes of approximately $1mm^2$.

Fig. 2B shows the same metal net in a schematic side view.

Fig. 3A shows in a perspective view a basic combination of metal nets. A plain metal net 3.1 (nearer to the flames) is connected to a corrugated distance metal net 3.2 by means of metal clips 4.

Fig. 3B shows a schematic side view of the unit shown in Fig. 3A.

Fig. 4A shows in a perspective view a complete structure of the extinguishing carpet 1n in Fig. 1. A plain metal net 3.3 (furthest from the flames) is connected through the corrugated distance net 3.2 with a plain metal net 3.1 by means of metal clips 4. The clips 4 connect the three nets with a certain play, in order for the structure to have sufficient flexibility to be rolled and unrolled. The changeable metal foil 2 is affixed to the metal net 3.3 at its edges.

Fig. 4B shows a schematic side view of the extinguishing carpet shown in Figs. 1 and 4A, with the metal foil 2 on its top side.

Fig. 5 illustrates a fire proof bulkhead, for aircraft, vehicles, ships or boats comprising an impervious metal wall 8 (to prevent air draught, smoke and toxic gases penetrating the bulkhead), attached by a flange 8.1 to the wall 10 of the particular type of transport. Metal nets of the structures and properties described in Figs. 3.1-3.4 (counted from the flames 6) are affixed by the block 9 to the flange 8.1. Passage through the nets converts the flames 6 into the gases 7 flowing up the impervious wall 8. Since no flames reach the latter it is heated only to a limited extent, and can be made both thin and light, a considerable gain in efficiency over existing massive fire-proof bulkheads.

Fig. 6 shows the application of the described net structure to the passive protection of a fuel tank, with wall 11, containing fuel 5t. It is covered with fire protecting nets 3.1 (plain), 3.2 (corrugated distance), 3.3 (plain) and 3.4 (corrugated distance) counting from the flames 6 of split fuel 5s. Having passed through the nets the flames 6 are again changed into gases 7 flowing along the tank wall 11. As no flames come into direct contact with the tank the danger of the tank catching fire or exploding are substantially reduced.

Fig. 7 shows the application of a fire-resisting system in the fuselage of an airliner (cross-sectional view). The system is placed between the outer surface 12ou and inner surface 12in of the fuselage forming a fire-resisting shell for passengers and crew in case of an accident. The shell comprises an impervious metal wall 13 (a sheet of, for example, dural about 0.2mm thick), and metal net or nets 14 comprising one or more units illustrated in Figs. 3, 5 and 6, which prevent flames coming from outside reaching the wall 13. Passengers and crew are therefore in comparative safety much longer than in a similar craft not protected in this way.

The described system of protection may be applied to the whole space of the cabin or to ring certain strips round, for example, emergency exits. It could alternatively be restricted to the floor area 15 under the passenger seats 16 where the risk is greatest. The weight and volume of the system is very small compared to the overall weight of the aircraft, and inexpensively gives a markedly higher chance of survival for passengers and crew alike.

An alternative application could be to fill a void in the aircraft wall with coarse metal foil instead of the nets. It is also possible that the impervious wall 13 may already be incorporated into the aircraft design.

Fig. 8 shows the application of a fire-resisting mat 1w laid in a corridor (of a building, mine, vehicle etc) with a wall 17w and a ceiling 17c. The mat would be similarly structured to the extinguishing carpet shown in Figs. 4A and 4B except that the middle corrugated distance net 3.2 is replaced by a filling of coarse metal wool (steel or brass) between nets 3.1 and 3.3, and the metal foil 2 is omitted.

Being rolled out on the burning floor 15 the mat 1w will extinguish the flames 6 and keep a safe strip forming an escape gangway.

The thickness of the mat 1w is up to 7mm maximum, and may be rolled up in the same way as the extinguishing carpet. The metal fibres in the wool must be coarse enough to prevent capillarity phenomena and dense enough to impede the penetration of gases.

Fig. 9 shows a fire-fighting application with a rigid extinguishing panel 1p comprising an extinguishing carpet 1n attached to a light supporting frame 20 (e.g. a grille). A plate 18 may be the deck of an oil tanker or other ship, the cover of an underground storage tank, or similar situation. There is an opening 19 in the plate 18.

The material under the plate 18 (which may be a ship's cargo, oil in a storage tank, or similar) is on fire, burning with flames 6. The rigid extinguishing panel 20 has been laid over the opening 19 in the direction DM2 and is being sprayed with water 21 from a hose 22.

The water helps to fill in the meshes in the net carpet 1n, and partially evaporates on the hot metal. The combination gives rise to a perfect seal to exclude the entry of atmospheric oxygen to the fire. Gases 7v cooled below their ignition point are rising, with the water vapour, above the plate 18.

This way of fire-fighting excludes the possibility of an explosion of gases accumulated under pressure, particularly important in oil tankers where fires may burn for several days in spite of continuous and intensive spraying with water. Permanent rigid panels may be laid over easily inflammable material (such as oil in oil tankers) to enhance its safety in transport. A similar role could be seen in aircraft carriers where fuel may be spilt below decks, and then ignite.

Fig. 10 illustrates the case of an aircraft which has made a belly landing where fuel is burning on the ground around it. The extinguishing carpet 1n may be pulled over the aircraft immediately reducing the fire to an extent that it may easily be extinguished by conventional methods. Escaping gangways may also be provided through the burning fuel by mats such as that shown in Fig. 17 for the escape of passengers and crew, and the safe approach of fire-fighting personnel. The elimination of high-flaring flames also reduces the risk of exploding fuel tanks.

Small extinguishing carpets could also be carried in motorcars, lorries and other road vehicles for the rapid containment of fires in the engine compartment, allowing their easy extinguishing with conventional means.

In addition to the examples detailed, other applications of these metal structures could be in racing cars, aircraft engine nacelles, and buildings where fire damage risks are disproportionate, for example archives, museums and galleries.

In conclusion it may be said that the described means and techniques are feasible, simple, inexpensive and highly effective. These means of fire-fighting and fire prevention are ecologically acceptable and capable of repeated use. They require no specific training in use, and can therefore be used by laymen. They can be handled manually, extended by hydraulic arms, or rolled out like domestic carpets. They are able to reduce any fire to an absolute minimum faster than any conventional means, a vital point in connection with the saving of life in vehicles, buildings and mines alike.

In passive protection applications these means are inexpensive, with low weight and volume combined with high efficiency.

CLAIMS

1. Regular and irregular metal structures characterised as metal nets or metal tangle, through which gases may easily pass, used in fire-fighting in the form of extinguishing covers or carpets immediately to reduce or extinguish fires by cooling; and similar structures used in passive fire protection by preventing the passage of flames through the metal structure by cooling the gases involved below their ignition points

2. Regular metal structures as claimed in Claim 1, wherein said extinguishing carpet comprises a metal net only

3. Regular metal structures as claimed in Claim 1, wherein said extinguishing carpet comprises more than one metal net, said nets being plain and shaped, attached to each other by clips, to form a unit of plain and shaped nets alternating in the carpet structure

4. Regular metal structures as in Claim 3, wherein said extinguishing carpet is provided with an impervious changeable metal foil on its top side preventing atmospheric oxygen fostering the fire

CLAIMS (cont'd)

5. Irregular metal structures as in Claim 1, wherein said extinguishing mat comprises coarse metal wool held between two plain metal nets forming a basic structural unit, said one or more units forming said mat

6. Regular metal structures as claimed in Claim 3, wherein said one or more units comprising one plain and one shaped metal net are attached together along with an impervious metal (sheet) wall to form a fire-proof bulkhead

7. Regular metal structures as claimed in Claim 3, wherein said one or more units comprising one plain and one shaped metal nets attached to each other form a fire-resisting cover for a fuel tank

8. Regular metal structures as in Claim 6, wherein said bulkhead forms a fire-resisting wall inserted between the outer and inner wall of an aircraft fuselage protecting passengers and crew from the effects of fire

CLAIMS (cont'd)

9. Irregular metal structures as claimed in Claim 1, wherein said metal tangle is coarse metal wool filled into the cavity between the outer and inner walls of an aircraft fuselage along with an impervious metal (sheet) wall protecting passengers and crew from the effects of fire

10. Irregular metal structures as claimed in Claim 5, wherein said mat is made of metal wool dense enough to impede the passage of gases to its surface, and which may be unrolled to form a safe gangway for escape for endangered personnel in corridors and other burning spaces in buildings, mines, vehicles and the like

11. Regular and irregular metal structures as claimed in Claim 1, wherein said metal structures are stiffened by a frame or grille to form a rigid panel, used to cover openings on ships' decks, underground storage tanks and the like; said panels being used in case of fire in materials in the ships' holds, or in the storage tanks, said panels being sprayed with water to form a water and vapour seal against atmospheric oxygen, resulting in the extinguishing of the fire

CLAIMS (cont'd)

12. Regular and irregular metal structures as claimed in claim 1, wherein the said structures are spread to extinguish surface fires of spilt petrol, oil, kerosene and the like on decks of ships, on airports, roads and the like, with simultaneous spraying of the said structures by water and other extinguishing liquids or foams

13. Regular metal structures as claimed in Claim 4, wherein said carpets are thrown on or pulled over burning objects like aircraft, vehicles etc containing endangered persons, so as to reduce the fire immediately and facilitate evacuation, allowing the fire to be completely extinguished using conventional means

14. Regular metal structures as claimed in Claims 2 and 3, wherein a small extinguishing carpet is provided for motor vehicles to enable engine fires immediately to be reduced to a minimum, allowing the fire easily to be extinguished by conventional portable extinguishers

15. Regular and irregular metal structures substantially as described herein with reference to Figures 1-10 of the accompanying drawings

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search Report)	Application number GB 9204022.9

Relevant Technical fields

(i) UK Cl (Edition L) A5A (A7, A25, A23, A20X1); E1T (T8B); D1K (K7); F2X (X7); F4A (RAB)

(ii) Int Cl (Edition 5) A62C

Search Examiner

DR D ELSY

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASES: WPI

Date of Search

5 JANUARY 1993

Documents considered relevant following a search in respect of claims 1-15

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 1446335 (SUMMA) See Claims 21-30	1, 3, 5-9
X	GB 0274170 (LAMBOURNE) See Figure 1 arnotations 8 and 11	1, 2
X	EP 0377397 A2 (SHAIKH) See Figure 3, abstract, column 2 line 23 - column 3 line 4, column 4 lines 21-35	1-3, 6, 7, 12, 14
X	US 4925053 (FENTON) See entire document	1-3, 6, 7
X	US 4602611 (HANKEY) Figure 2, column 2 lines 23-24, Claim 2	1, 5
X	US 4361190 (SZEGO) See column 1 lines 7-19 column 3 lines 31-66	1, 5, 10

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

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